CLAIMS

What is claimed is:

1. A variable speed wind turbine comprising:

an electrical generator to provide power for a power grid; and

a power conversion system coupled to the electrical generator, the power conversion system including a passive grid side rectifier, the power conversion system to provide power from the power grid to the electrical generator using the passive grid side rectifier.

2. The variable speed wind turbine of claim 1, wherein the power conversion system is to provide power from the power grid to the electrical generator at below synchronous speed.

3. The variable speed wind turbine of claim 1, wherein the power conversion system further includes an active generator side inverter coupled to the passive grid side rectifier via a direct current (DC) link and a power dissipating element.

4. The variable speed wind turbine of claim 3, further comprising:

a processor coupled to the power conversion system to control the active generator side inverter and the power dissipating element.

5. The variable speed wind turbine of claim 4, wherein the processor is to control electrical quantities on the power grid by controlling the active generator side inverter.

6. The variable speed wind turbine of claim 5, wherein the power grid is a three phase power grid and the processor is to control independently electrical quantities for each phase of the power grid.

7. The variable speed wind turbine of claim 4, wherein the processor is to control the power dissipating element to dissipate excess power from the electrical generator at above synchronous speed.

8. The variable speed wind turbine of claim 4, wherein the processor is to provide scalar control of the active generator side inverter.

9. The variable speed wind turbine of claim 1, further comprising:

at least one of a Y connector and a delta Δ connector to connect the electrical generator to the power grid.

10. A variable speed wind turbine comprising:

means for generating power to a power grid;

a power conversion system to provide power from the power grid to the means for generating power at below synchronous speed and to dissipate excess power from the means for generating power at above synchronous speed; and

a controller coupled to the power conversion system to control the power conversion system and to provide power control for the means for generating power.

11. A system comprising:

a generator side converter;

a direct current (DC) link coupled to the generator side converter;

a power dissipating element coupled to the DC link to selectively dissipate excess power from a generator; and

a passive grid side rectifier to convert fixed frequency alternating current (AC) signals from a power grid to DC voltage,

wherein the DC voltage is supplied to the generator side converter via the DC link and the generator side converter is to convert the DC voltage into variable frequency AC signals for the generator.

12. A method for a variable speed wind turbine comprising:

supplying power from a power grid to an electrical generator using a passive grid side rectifier at below synchronous speed.

13. The method of claim 12, further comprising:

dissipating excess power from the electrical generator using a power dissipating element at above synchronous speed.

14. A method of operating a variable speed wind turbine, comprising:

configuring at least two phases of a stator or a generator for connection to a utility grid;

providing a plurality of switches on the rotor-side of a generator; and

controlling the switches such that electrical quantities for at least two phases of the utility grid are controlled independently.

15. A variable speed wind turbine comprising:

an electrical power generating system to provide power to a power grid;

a controller coupled to the electrical power generating system to control the electrical power generating system based on an error signal; and

a pitch controller coupled to the electrical power generating system and the controller, the pitch controller receiving a signal based on the error signal.

16. The variable speed wind turbine of claim 15, wherein the error signal is based on total output power and reactive power on the power grid.

17. The variable speed wind turbine of claim 15, wherein the controller coupled to the electrical power generating system is to control total power output to the power grid.

18. The variable speed wind turbine of claim 15, wherein the controller coupled to the electrical power generating system is to control electrical quantities on each phase of the power grid.

19. The variable speed wind turbine of claim 15, wherein the controller coupled to the electrical power generating system is to operate at a faster speed than the pitch controller.

20. The variable speed wind turbine of claim 15, wherein the signal is based on the error signal, the signal is used for selecting between a full load controller and a partial load controller.

21. A method for controlling power from an electrical generator to a power grid comprising:

receiving voltage values and current values of the power grid relative to a time-based system;

calculating active and reactive power from the voltage and current values without converting from the time-based system;

determining a power error based on the active and reactive power;

generating current reference values to control rotor currents in the electrical generator based on the determined power error without converting from the time-based system; and

controlling the rotor currents in the electrical generator based on the current reference values.

22. The method of claim 21, wherein the receiving of the voltage values and current values includes receiving the voltage and current values for each phase of the power grid.

23. The method of claim 22, wherein the calculating of the active and reactive power includes calculating the active and reactive power for each phase of the power grid using the voltage and current values for each of the power grid.

24. The method of claim 21, wherein the generating of the current reference values includes generating the current reference values based on the determined power error, a power grid frequency, and a generator speed.

25. The method of claim 21, wherein the controlling of the rotor currents in the electrical generator includes controlling the rotor currents for each phase of the rotor in the electrical generator based on the current reference values.

26. The method of claim 21, further comprising:

controlling electrical quantities in each phase of the power grid by controlling the rotor currents in the electrical generator.

27. A system for controlling power from an electrical generator to a power grid comprising:

means for receiving voltage values and current values of the power grid relative to a time-based system;

means for calculating active and reactive power from the voltage and current values without converting from the time-based system;

means for determining a power error based on the active and reactive power;

means for generating current reference values to control rotor currents in the electrical generator based on the determined power error without converting from the time-based system; and

means for controlling the rotor currents in the electrical generator based on the current reference values.

28. The system of claim 27, wherein the means for generating current reference values includes means for generating current reference values without converting from a time-based system.

29. The system of claim 27, wherein the means for receiving of the voltage values and current values includes means for receiving the voltage and current values for each phase of the power grid.

30. The system of claim 29, wherein the means for calculating of the active and reactive power includes means for calculating the active and reactive power for each phase of the power grid using the voltage and current values for each of the power grid.

31. The system of claim 27, wherein the means for generating of the current reference values includes means for generating the current reference values based on the determined power error, a power grid frequency, and a generator speed.

32. The system of claim 27, wherein the means for controlling of the rotor currents in the electrical generator includes means for controlling the rotor currents for each phase of the rotor in the electrical generator based on the current reference values.

33. The system of claim 27, further comprising:

means for controlling electrical quantities in each phase of the power grid by controlling the rotor currents in the electrical generator.

34. A method of controlling the pitch of a wind turbine blade, comprising:

determining if a power error signal exceeds at least one predetermined boundary; and

sending a signal to a pitch controller based on the determining to change the pitch of the wind turbine blade.

35. The method of claim 34, further comprising:

assigning a value to the signal based on a measured pitch angle and the power error signal.

36. The method of claim 34, further comprising:

assigning a neutral value to the signal when the power error signal does not the at least one the predetermined boundary.

37. A system for controlling the pitch of a wind turbine blade, comprising:

means for determining if a power error signal exceeds at least one predetermined boundary; and

means for sending a signal to a pitch controller based on the determining to change the pitch of the wind turbine blade.

38. The system of claim 37, further comprising:

means for assigning a value to the signal based on a measured pitch angle and the power error signal.

39. The system of claim 37, further comprising:

means for assigning a neutral value to the signal when the power error signal does not exceed the at least one predetermined boundary.